QUALITY ASSURANCE PROJECT PLAN

Dry and Wet Weather Metals (Copper, Lead, and Zinc) Water Quality Sampling Of Indian Run Brook and Sources

Rhode Island Department of Environmental Management

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Attachments

List of Tables

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2.0 Document Format

A copy of the completed EPA Worksheet No. 2 is provided in Attachment A. The worksheets and/or required information that are not applicable or are in a format other than an EPA worksheet are summarized in Table 1 with a brief explanation.

Table 1 Required QAPP elements checklist.

EPA Worksheet	Section	Location	Comments
1	1.0	Cover Page	
2	2.0	Attachment A	
3	3.0	Section 3.0	Table 2
4	3.0	Section 3.0	Narrative
5a	4.0	Section 4.1	Narrative
5b	4.0	Section 4.2	Narrative
6	4.0	Section 4.3	Narrative
7	4.0	Section 4.2	Narrative
8a	5.0	Attachment A	
8b	5.0	Section 5.2	Narrative
9a	6.0	Section 5.0	Narrative
9b	6.0	Attachment A	
9c	6.0	Attachment A	
9d	6.0	Attachment A	
10	6.0	Section 6.2	Table 3
11a	7.0	Sections 7.1 & 7.2	Narrative
11b	7.0	Attachment A	
12a	8.0	Section 8.1	Narrative and Table 4 and 5
12b	8.0	Attachment A	
13	9.0	Section 9.1	Table 6
14	9.0	Section 9.3	Table 7
15	9.0	Section 9.3	Table 8
16	10.0	Section 10.2	Table 9
17	11.0	Not Attached	No field analysis
18	11.0	Not Attached	No field analysis
19	11.0	Not Attached	No field analysis
20	12.0	Section 12.1	Table 10
21	12.0	Not Attached	See lab SOPs Table 10
22a	13.0	Attachment A	
22b	13.0	Not Attached	Refer to EPA Worksheet 22a
23a	13.0	Not Attached	No field analysis
23b	13.0	Not Attached	No field analysis
24a	13.0	Attachment A	
24b	13.0	Section 13	Narrative
25	14.0	Section 14.0	Table 11
26	15.0	Section 15.0	Table 12
27a	16.0	Section 16.0	Narrative
27b	16.0	Section 16.0	Table 13
27c	16.0	NA	Project Assessment Plan
28	17.0	Section 17.0	Table 14
29a	19.0	Section 19.0	Table 15
29b	19.0	Attachment A	EPA Worksheets 11b, 22a, and 24a
29c	19.0	NA	Data validation Modifications
30	20.0	Attachment A	EPA Worksheets 11b, 22a, and 24a

3.0 Distribution List and Project Personnel Sign-Off Sheet

The distribution list documents to whom copies of the approved QAPP and any subsequent revisions will be sent. The distribution list is provided in Table 2.

Table 2 Distribution List

QAPP Recipient	Title	Organization	Telephone Number
Steve DiMattei	Quality Assurance Chemist	USEPA, NE Region I	(781) 860-4369
Brandon Faneuf	Environmental Scientist/Project Manager	RIDEM	(401) 222-4700 x 7419
Wayne Jenkins	Principal Environmental Scientist	RIDEM	(401) 222-4700 x 7272
Claude Masse	RIDEM QA Officer	RIDEM	(401) 222-4700 x 7244
Doug Cullen	Laboratory Manager	Microinorganics, Inc.	(401) 782-8166
Karen Gavitt	Laboratory Supervisor	MITKEM, Inc.	(401) 732-3400

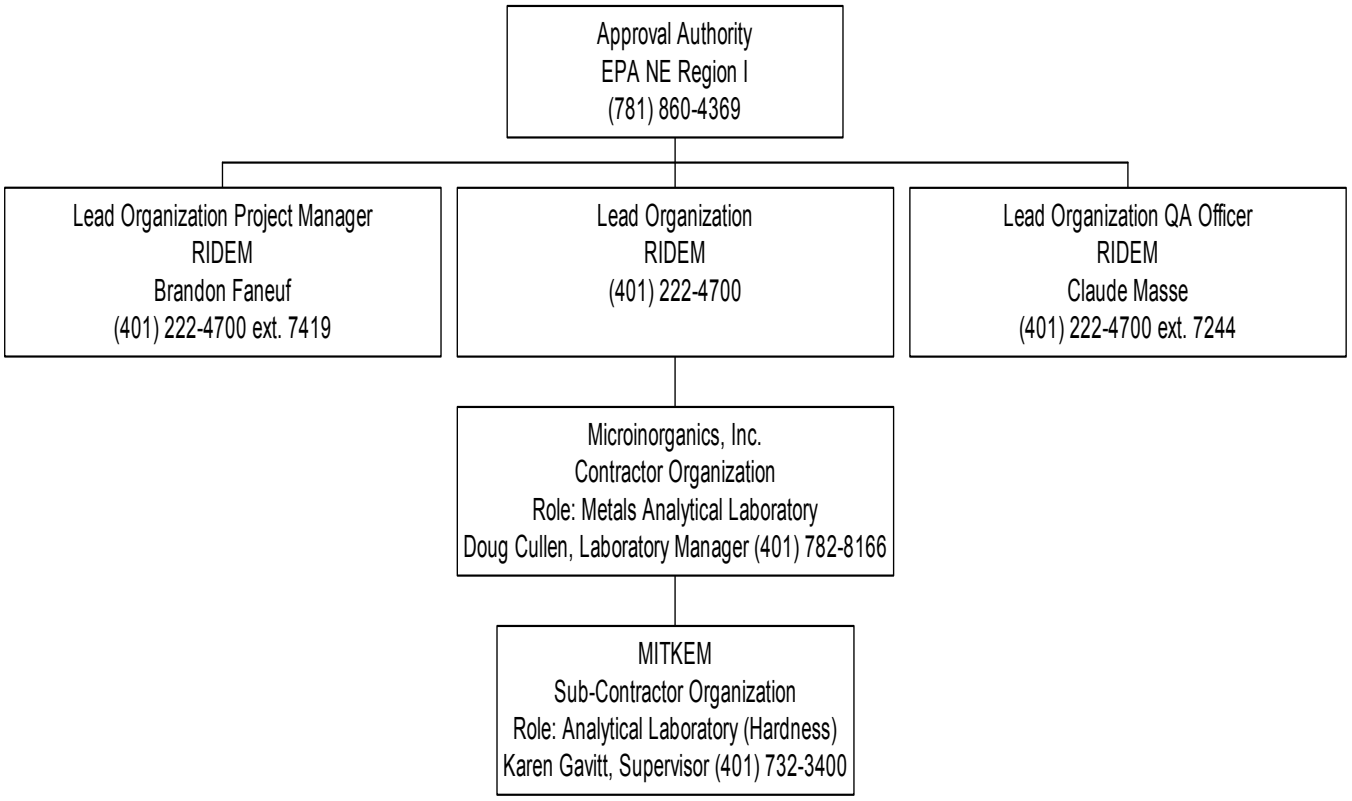
In addition to the distribution list, all personnel in the organization chart will receive a copy of the QAPP. A separate Project Personnel Sign-Off Sheet was not developed for this project.

4.0 Project Organization

The project organization chart is provided below. This chart identifies reporting relationships between the Lead Organization and other organizations, including contractors and sub-contractors and their contact information.

4.1 Project Organizational Chart

Figure 1 Organizational Chart



4.2 Communication Pathways

It is anticipated that RIDEM personnel will conduct all sampling activities for this project. The Project Manager will contact all potential sampling personnel via email when the survey season begins. The Project Manager will be responsible for contacting Microinorganics, Inc. to order all necessary sampling containers and to alert the laboratory to incoming samples. It will be the responsibility of Microinorganics, Inc to contact its sub-contractor, MIKEM. The Project Manager and the QA Officer will coordinate to determine when sampling climatic criteria (i.e. dry weather surveys conducted when an antecedent dry period of 3 days with rainfall <0.03 inches and wet weather surveys conducted when a 24-hour period with rainfall >0.5 inches) have been or are likely to be achieved.

Sampling personnel will be alerted via email of the time and date of sampling and a

"tailgate meeting" will be conducted at a predetermined location before sampling commences. It is likely that changes to the sampling plan may occur during the course of sampling due to safety considerations after dark or during storm flows. Decisions to alter the sampling plan will be made jointly by the Project Manager and QA Officer and all changes made in the field will be documented in the field notes. All changes to the QAPP will be reported in each Status Report and the Final Report.

4.3 Personnel Responsibilities and Qualifications

RIDEM personnel with surface water quality sampling experience will conduct all sampling. Resumes of RIDEM personnel are on file at the RIDEM office in Providence, Rhode Island. Doug Cullen, Laboratory Manager for Microinorganics, Inc., will be responsible for the laboratory analysis of the surface water samples for copper, lead, zinc, and hardness. His resume is on file at the Microinorganics, Inc. laboratory in Narragansett, Rhode Island. The actual laboratory analysis for hardness will be conducted by MITKEM, a sub-contractor to Microinorganics, Inc. The resume for Karen Gavitt, Supervisor at MITKEM, is on file at MITKEM, in Warwick, Rhode Island.

5.0 Project Planning/Problem Definition

TMDLs are required under Section 303 (d) of the Clean Water Act and USEPA's Water Quality Planning and Management Regulations (40 CFR Part 130). The goal of the TMDL study is to quantify the existing copper, lead, and zinc loadings from nonpoint and point sources into Indian Run Brook. At the completion of the study, the necessary load reductions needed to achieve water quality standards will be established.

RIDEM is currently conducting a comprehensive water quality characterization of the Saugatucket River watershed. During this characterization, RIDEM will organize all existing information and gather any additional information needed to develop a metals (copper, lead, and zinc) total maximum daily load (TMDL) for Indian Run Brook. Currently, Indian Run Brook is listed on the 303(d) list as being impaired by copper and lead. A review of the data from the URI study, subsequent to the 2000 303(d) listing, indicated that Indian Run Brook was also impaired by zinc. The goal of this sampling program is to document instream water quality conditions and quantify the largest inputs into the brook during dry and wet weather events.

5.1 Project Planning Meetings

Project scoping meetings were held to define the purpose and expected results of the project, the environmental decisions that need to be made, the sampling, analytical, and data assessment activities that will be performed, and the format, content, and timetable for the TMDL. Each of the project scoping meetings are documented in EPA Worksheet No. 8a in Attachment A.

5.2 Problem Definition/Site History and Background

Indian Run Brook flows from northeast to southwest through South Kingstown and is located within the Saugatucket River watershed (refer to Figure 2). The stream originates in a swamp east of the length of Route 1 that is adjacent Indian Lake (Figure 3) and has an approximate length of 4.5 miles. The upper portion of Indian Run Brook is located within forest and wetland habitat while the lower portion runs through suburban sections of Wakefield before its confluence with the Saugatucket River approximately 300-feet south of the Palisades mill complex. Indian Run Brook has one major impoundment, Indian Run Reservoir. The Reservoir is located east of Kingstown Road in Wakefield and is immediately adjacent to Old Mountain Field Recreational Area.

Indian Run Brook has a second, smaller impoundment, located immediately north of Saugatucket Road. This impoundment has no name, and is 1.43 acres in size. It is accessible from a dirt parking/turnaround area adjacent Saugatucket Road. Although a crude dam made of fieldstone is present near its outlet under Saugatucket Road, it is more a function of backup due to an undersized culvert running under the road. Further, the road appears to be originally built upon the swamp that is associated with the stream, possibly causing further hydrological backup.

A study conducted by the University of Rhode Island (URI) (Wright et al., 1999) provided metals data for Indian Run Brook that indicates an impairment at the station sampled at the confluence of Indian Run Brook and Saugatucket River. Based on the RIDEM chronic standard, the water quality goal for dissolved copper concentrations in Indian Run Brook was calculated to be 3.47 µg/l, 0.54 µg/l for lead, and 32.29 µg/l for zinc. Furthermore, the four-day concentration of copper, lead, and zinc shall not exceed these criteria more than once every three years on average. The criteria shall not be exceeded at or above the lowest average 7 consecutive day low flow with an average recurrence frequency of once in 10-years (7Q10). The goal of this sampling program is to document instream water quality conditions and quantify the largest inputs into the brook during dry and wet weather conditions.

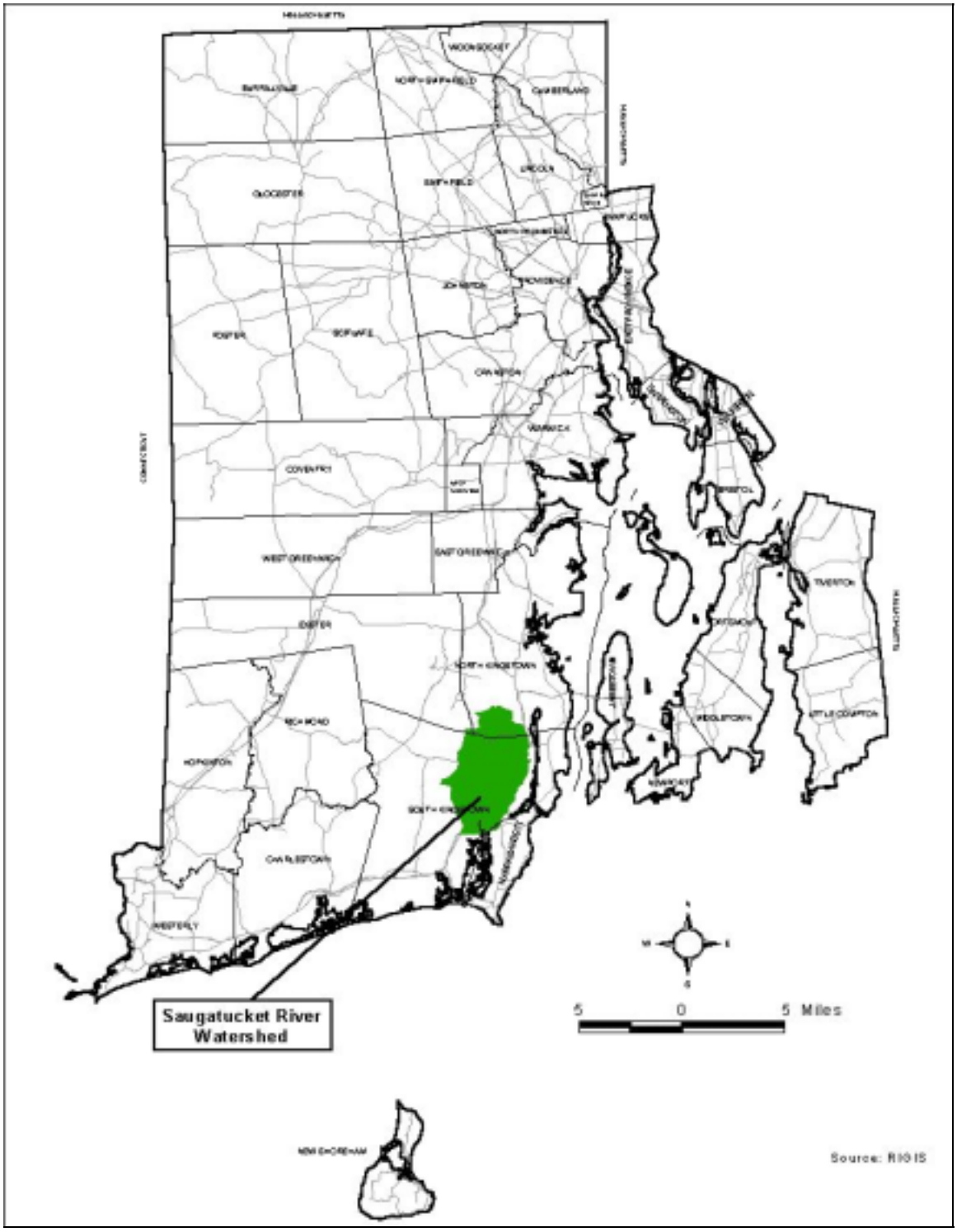


Figure 2 Saugatucket River Watershed

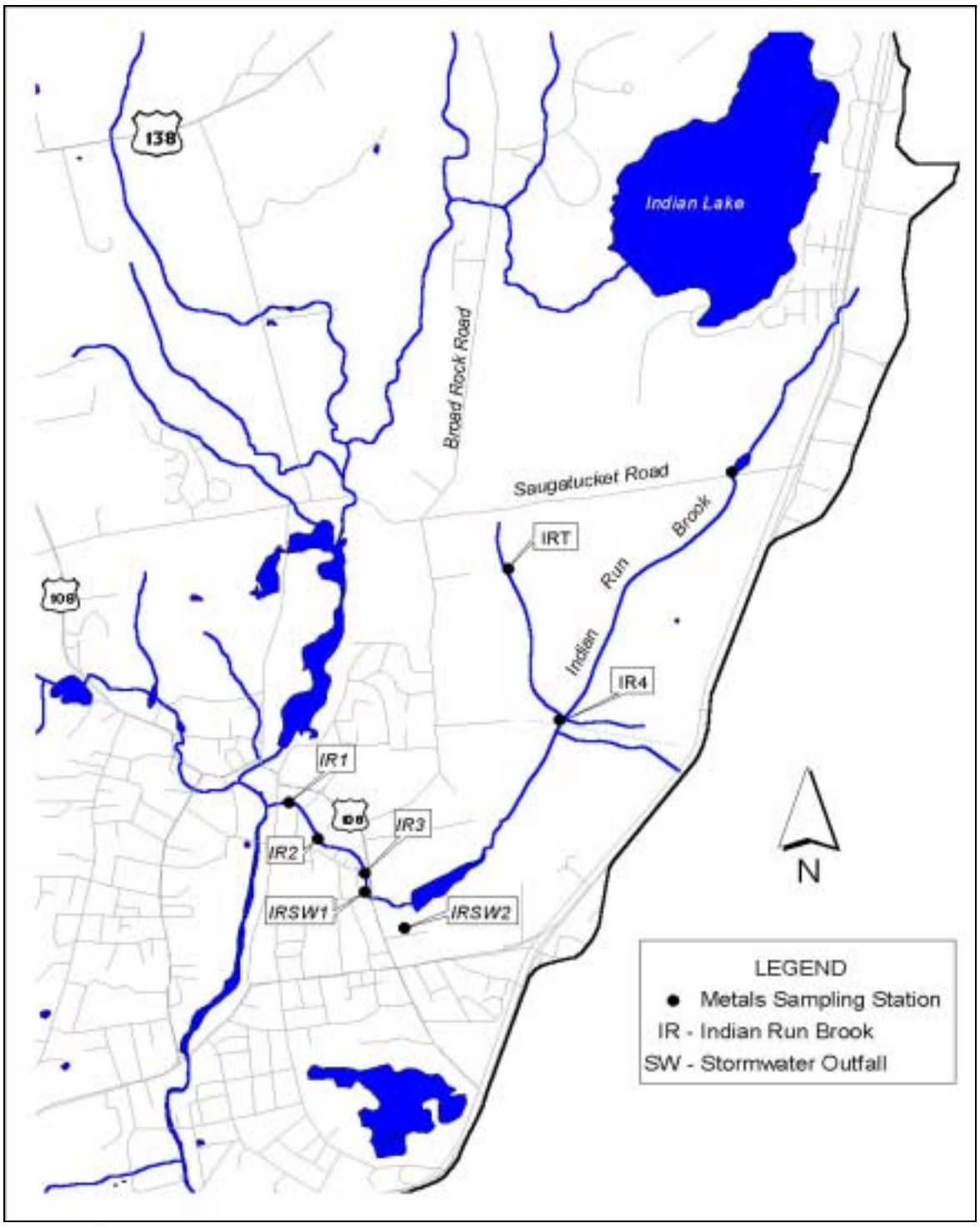


Figure 3 Indian Run Brook metals sampling stations.

6.0 Project Description and Schedule

A TMDL report is required by the Clean Water Act for all waterbodies that exceed water quality criteria. Indian Run Brook exceeds RIDEM water quality criteria for copper, lead, and zinc. The TMDL must quantify the loads that the brook can receive during dry and wet weather events and still meet water quality standards.

The requirements of the TMDL process help determine the scope of the Indian Run Brook study. RIDEM will quantify the copper, lead, and zinc loads to the brook and monitor instream water quality to determine the impact of these loads. RIDEM anticipates beginning the sampling portion of the study during the spring of 2001.

6.1 Project Overview

Based on a review of existing studies conducted within the Saugatucket River watershed, water quality data gaps were identified and the need for additional monitoring was established. The objective of this project is to provide additional monitoring data to characterize water quality conditions within Indian Run Brook, a subwatershed of the Saugatucket River watershed. The data collected will be used in the development of total maximum daily loads (TMDLs) for metals reductions within the subwatershed. The contaminants of concern and other target analytes are listed in EPA Worksheet No. 9b, provided in Attachment A. Field and quality control samples are summarized in EPA Worksheet Number 9c and the laboratory analytical services information are summarized in EPA Worksheet 9d, both provided in Attachment A

6.2 Project Schedule

Table 3 Proposed project schedule.

Task	Deliverable	2000				2001									
		N	D	J	F	M	A	M	J	J	A	S	O	N	D
Review Existing Data	Monitoring Plan														
QAPP Preparation	QAPP Document														
Site Preparation	NA														
Sample Collection	NA														
Laboratory Analysis	Laboratory Report														
Final Data Report	Final Data Report														

7.0 Project Quality Objectives and Measurement Performance Criteria

7.1 Project Quality Objectives

The data generated from this project will be used by RIDEM to identify sources of copper, lead, and zinc within the subwatershed and to develop a metals TMDL for Indian Run Brook. All the data quality objectives will be met if the data collected is sufficient to complete the TMDL.

RIDEM water quality criteria for metals are presented as dissolved metals criteria to more closely approximate the bioavailable fraction of metal in the water column. The freshwater acute and chronic criteria for dissolved copper, lead, and zinc are presented as Freshwater Criteria Equations and Base e Exponential Values in Appendix B, Table 2 of the Water Quality Regulations. Hardness is a component of the equation and must be determined. It should be noted that the minimum hardness value allowed for use in those equations is 25 mg/L, as calcium carbonate, even if the actual ambient hardness is less than 25 mg/L as calcium carbonate. For these reasons, all samples collected for this study will be analyzed for dissolved metals and hardness.

7.2 Measurement Performance Criteria

Collecting high quality data is one of the most important goals of this project. Specific data quality objectives include precision, accuracy, representativeness, comparability, and completeness. Measurement performance criteria are briefly presented below and are also found on EPA Worksheet No. 11b in Attachment A.

Precision
Precision is the degree of agreement among repeated measurements of the same characteristic under the same or similar conditions. The QC sample used to measure overall precision will consist of field duplicates. Duplicate precision is evaluated by calculating the Relative Percent Difference (RPD) and will considered precise if the RPD is less than 20 percent. The QC sample used to measure laboratory precision will consist of a matrix spike (MS) and a matrix spiked duplicate (MSD). Laboratory analysis will be considered precise if the RPD is less than 20 percent.

Accuracy/Bias
Accuracy is the extent of agreement between an observed value (sample result) and the true value of the parameter being measured. Bias describes the systematic or persistent error associated with a measurement process. These terms are used interchangeably in this document. Accuracy will be measured using an MS and MSD and a Standard Reference Material (SRM) and will be considered accurate if the recovery is within 51 to 145 percent of the true value for copper and zinc, 60 to 120 percent for lead, and 75 to 125 percent for total hardness.

Representiveness
The selected stations and sampling frequency were chosen for their representativeness of conditions in the Indian Run Brook subwatershed. The extent to which the measurements represent actual environmental conditions will be somewhat restricted by the time of year the samples are collected and the overall weather conditions of that year (i.e. dry versus wet year).

Comparability
To maximize the quality of the data collected, and to collect data that is comparable with other studies, accepted sampling procedures will be used during this study. All samples collected will be sent to laboratories that use standard methods. Stream discharge will be measured using the protocols from Rantz, et al. (1982).

Completeness
If the data collected is sufficient to complete the TMDL report, then the data is considered to be complete. Measurement performance criteria help determine the completeness of a data set.

Measurement performance criteria is summarized in EPA Worksheets No. 11b, provided in Attachment A.

8.0 Sampling Process Design

This section describes the sampling system in terms of what media/matrices will be sampled, where the samples will be taken, the number of samples to be taken and the sampling frequency.

8.1 Sampling Design Rationale

The media to be sampled will consist of surface water from Indian Run Brook and stormwater from two storm drain outlets that discharge to Indian Run Brook. The objectives of the field portion of the project are to:

1. Collect representative surface water samples during two (2) dry weather and one (1) wet weather event for the analysis of dissolved metals (copper, lead, and zinc);
2. To measure streamflow during each sampling event; and
3. To measure the rainfall during the storm.

Two dry weather surveys and the one wet weather survey will be conducted during the summer of 2001. The first survey is scheduled during dry weather conditions in early/mid July 2001. The second survey is scheduled during a wet weather event in July/August. The third and final survey will be scheduled during dry weather conditions

in August/September 2001. Approximately 30 metals samples will be collected over the course of the study that will be analyzed for copper, lead, and zinc. In addition, hardness samples will be collected. A brief description of sampling activities is presented below. A more detailed sampling standard operating procedure (SOP) is presented in Attachment B and is entitled, "Manual (Grab) Sampling of Ambient Water for Dissolved and/or Total Recoverable Trace Metals at EPA Water Quality Criteria Levels (SOP-FS02)." Sample station locations, purpose/justification of locations, and parameters, are listed in Table 4.

Table 4 Indian Run Brook sampling station information.

Station ID	Name	Description	Parameters	Purpose
IR1	Indian Run @ Columbia St. (URI station)	In-Stream: Upstream of bridge	Dissolved Cu, Pb, Zn and stream discharge	Replicate URI monitoring station
IR2	Indian Run @ end of Amos Street	In-Stream	Dissolved Cu, Pb, Zn and stream discharge	Isolate metals load between Route 108 and Columbia Street/Saugatucket River
IR3	Indian Run @ Rt. 108	In-stream: Downstream of bridge	Dissolved Cu, Pb, Zn and stream discharge	Isolate metals load from street runoff.
IRSW1	Indian Run @ Church St. end	Stormwater outfall below bridge (wet weather only)	Dissolved Cu, Pb, Zn and stream discharge	Isolate metals loads from street runoff.
IRSW2	Indian Run @ Indian Run Village Entrance	Stormwater outfall north of entrance road to Indian Run Village (wet weather only)	Dissolved Cu, Pb, Zn and stream discharge	Isolate loads from street and parking lot runoff
IR4	Indian Run at access road (St. Dominics)	In-Stream: Downstream of access road bridge and tributary inputs	Dissolved Cu, Pb, Zn and stream discharge	Isolate loadings upstream of access road
IRT	Indian Run Tributary (Lewis Lane)	In-Stream: Downstream of access road bridge	Dissolved Cu, Pb, Zn and stream discharge	Isolate loadings from old landfill

A summary of the number of field and QC samples that will be collected is provided in EPA Worksheet No. 9c in Attachment A.

To determine antecedent dry periods and wet weather sampling criteria, RIDEM will use

data collected at the National Weather Service Cooperative Observer, Kingston, Rhode Island Station and from rain gages maintained and operated by RIDEM. The National Weather Service Cooperative Observer, Kingston, Rhode Island Station is maintained and operated by the University of Rhode Island's Plant Science Department and is further described in Section 14.0, Data Acquisition Requirements. RIDEM will also install two Rainew tipping bucket rain gauges. The rain gauges will be installed in central locations of the subwatershed. A rain gauge will be installed in Old Mountain Field Recreational Area, proximate to Indian Run Reservoir. The second rain gauge will be installed in a field at the Dominic Savio Center, proximate to IR4. The rain gauge SOPs are presented in Attachment B.

Microinorganics, Inc will provide all sample containers. The sample parameters and characteristics are summarized in Table 5. Microinorganics, Inc., following the SOPs presented in Attachment C, will conduct all laboratory analytical tasks.

Table 5 Sample parameters and characteristics.

Parameter	Matrix	Sample Volume (container)	Preservation	Maximum Holding Time	Method
Lead	Surface Water	250 ml LDPE* (cleaned per SOP-C01; refer to Attachment C)	**Stored on ice (4°C)	24 hours prior to filtration	EPA Method 1637
Copper	Surface Water	250 ml LDPE (cleaned per SOP-C01; refer to Attachment C)	**Stored on ice (4°C)	24 hours prior to filtration	EPA Method 1637
Zinc	Surface Water	250 ml LDPE (cleaned per SOP-C01; refer to Attachment C)	**Stored on ice (4°C)	24 hours prior to filtration	EPA Method 1639
Hardness	Surface Water	250 ml LDPE (cleaned per SOP-C01; refer to Attachment C)	HNO_3, pH<2	6 months	EPA Method 200.7

*LDPE = Low Density polyethylene
**Dissolved metals will be preserved with nitric acid after the samples are filtered in the laboratory.

The stream flow measurements will be conducted in the field following the SOP presented in Attachment B. Each time a station is sampled, the stage height will be read off the staff gage at the site following Field Sampling SOP 2 (S-2) in Attachment B. The product of the stream discharge and instream concentration at each station will yield the pollutant of concern (copper, lead, and zinc) loading rates.

9.0 Sampling Procedures and Requirements

9.1 Sampling Procedures

Standard operating procedures for field sampling are located in Attachment B. Dissolved metals samples will be filtered and preserved with nitric acid at the laboratory.

Table 6 Project sampling SOP References.

Reference Number/Title	Originating Organization	Equipment Identification	Modified for Work Project
Field Sampling SOP 1 (FS-02) Metals Sampling	Microinorganics	Sample bottles	No
Field Sampling SOP 2 (S-2) Reading the Staff Gage	RIDEM	Not Applicable	No
Field Sampling SOP 3 (S-3) Measuring Culvert Stage and Flow	RIDEM	Marsh-McBirney, Inc. Models 201D and 2000 Portable Flow Meters	No
Field Sampling SOP 4 (S-4) Installation and Operation of RainWise® Inc. Tipping Bucket Rain Gauge	RIDEM	RainWise® Inc. Rainew Tipping Bucket Rain Gauge	No
Field Sampling SOP 5 (S-5) Measuring Stream Discharge	RIDEM	Marsh-McBirney, Inc. Models 201D and 2000 Portable Flow Meters	No
Field Sampling SOP E-1 (E-1) Current Meter Calibration	RIDEM	Marsh-McBirney, Inc. Models 201D and 2000 Portable Flow Meters	No

9.2 Equipment Cleaning

Samples will be collected using the pre-cleaned bottles provided by the analytical laboratory, and as such, sampling equipment cleaning is not anticipated.

9.3 Field Equipment Calibration and Maintenance

The Project Manager will ensure that all field equipment is operating properly.

Table 7 Field sampling equipment calibration.

Equipment	Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	SOP Reference
Marsh-McBirney, Inc. Model 201D Portable Water Flow Meter	Zero Check Zero Adjust	Before Sampling Season	±0.05 ft/sec	Send to Factory	E-1
Marsh-McBirney, Inc. Model 2000 Portable Flow Meter	Zero Check Zero Adjust	Before Sampling Season	±0.05 ft/sec	Zero Adjust	E-1

Table 8 Field equipment maintenance, testing, and inspection.

Equipment	Activity	Frequency	Acceptance Criteria	Corrective Action	SOP Reference
Marsh-McBirney, Inc. Model 201D Portable Water Flow Meter	Clean Sensor	Once before Sampling Season or as Needed	Visibly free of non-conductive grease or oils	Clean Sensor	S-5
Marsh-McBirney, Inc. Model 201D Portable Water Flow Meter	Batteries	Before Sampling or as Needed	Display 9.8 and 10.2 within 10 seconds	Change Batteries	S-5
Marsh-McBirney, Inc. Model 2000 Portable Flow Meter	Clean Sensor	Once before Sampling Season or as Needed	Visibly free of non-conductive grease or oils	Clean Sensor	S-5
Marsh-McBirney, Inc. Model 2000 Portable Flow Meter	Batteries	Low Battery Flag is displayed	Low Battery Flag is not displayed	Change Batteries	E-1

10.0 Sample Handling, Tracking, and Custody Requirements

10.1 Sample Collection Documentation

This section describes field documentation procedures that will be followed for the project.

10.1.1 Field Notes

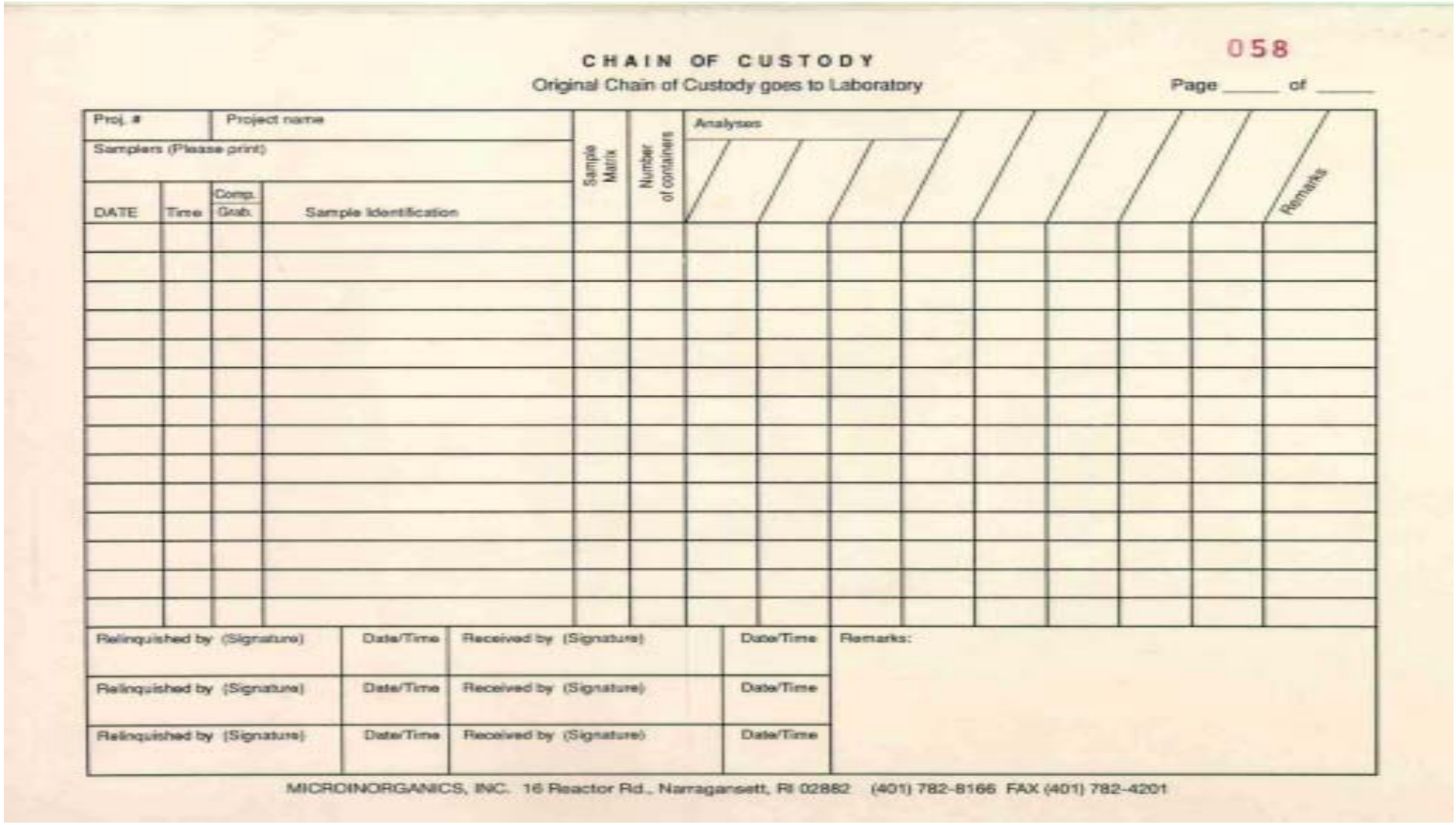
Sample teams will utilize either field notebooks or field log sheets to record relevant information prior to and during sampling events to include the following minimum information: Time of arrival at site, time storm began (wet weather sampling only), related site sketches, and general observations/comments. A copy of a blank field sheet is presented in Attachment E. Field notebooks will contain the same information as the field log sheets.

10.2 Sample Handling and Tracking System

Immediately prior to collecting each sample, the sample label will be filled out completely using a permanent marker. All samples will be placed in a cooler with ice immediately after the sample is collected. Ice will be packed twice into large ziplock bags sealed further with duct tape. Due to the very low detection limits (sub-ppb) for the metals analysis and the possibility of cross contamination, Microinorganics, Inc. recommends not using labels. Sample identification will be written on the sample bottle and a zip-lock bag using permanent marker. The sample bottle will be placed in the zip-lock bag and sealed, immediately after sampling.

Samples will be delivered to the laboratory the same day they are collected. All samples will be transported to the laboratory under proper chain-of-custody protocol. A copy of a blank Microinorganics, Inc. chain-of-custody is presented in Figure 5.

Figure 5 Microinorganics, Inc. chain-of-custody form.



CHAIN OF CUSTODY

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Original Chain of Custody goes to Laboratory

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Proj. #	Project name			Sample Matrix	Number of containers	Analyses								Remarks
Samplers (Please print)														
DATE	Time	Comp. / Grab	Sample Identification											

Relinquished by (Signature)	Date/Time	Received by (Signature)	Date/Time	Remarks:
Relinquished by (Signature)	Date/Time	Received by (Signature)	Date/Time	
Relinquished by (Signature)	Date/Time	Received by (Signature)	Date/Time	

MICROINORGANICS, INC. 16 Reactor Rd., Narragansett, RI 02882 (401) 782-8166 FAX (401) 782-4201

The flow of samples from the time of collection, to laboratory delivery, to final sample disposal is summarized in Table 9.

Table 9 Sample handling system

Action	Responsible Party
Sample Collection	RIDEM
Sample Delivery	RIDEM
Sample Analysis	Microinorganics, Inc.
Sample Archival	Not Applicable
Sample Disposal	Microinorganics, Inc.

11.0 Field Analytical Method Requirements

During sampling, no field analysis will occur.

12.0 Fixed Laboratory Analytical Method Requirements

12.1 Fixed Laboratory Analytical

All samples will be taken to Microinorganics, Inc, of Narragansett, Rhode Island. Table 10 summarizes the laboratory SOPs presented in Attachment C.

Table 10 Microinorganics Laboratory SOPs

Reference Number	Title	Definitive or Screening Data	Analytical Parameter	Instrument	Modified for Project
C01	Bottle Cleaning Procedures for use in Collection of Trace Metals at AWQC* Levels	Not Applicable	Metals (Copper and Lead)	Not Applicable	No
P01	Preconcentration of Dissolved Metals from Aqueous Samples using APDC-cobalt chloride coprecipitation Technique	Not Applicable	Metals (Copper and Lead)	Not Applicable	No
A01	Graphite Furnace Analysis of Preconcentrated Water Samples	Definitive	Metals (Copper and Lead)	GFAAS**	No
A02	Direct Injection Analysis of Dissolved and Total Recoverable Trace Elements in Ambient Waters by Stabilized Temperature Graphite Furnace Atomic Absorption	Definitive	Metals (Zinc)	GFAAS**	No
A03	Determination of Metals in Water and Wastes by Inductively Coupled Argon Plasma Atomic Emission Spectrometry	Definitive	Hardness (Ca and Mg)	ICP***	No

*AWQC = Ambient Water Quality Criteria
** GFAAS = Graphite Furnace Atomic Absorption Spectrotometry
***ICP = Inductively Coupled PLasma

13.0 Quality Control Requirements

Quality control (QC) is the system of technical activities that measures the performance of a process. Field sampling and laboratory QC protocols are presented in this section.

13.1 Field Quality Control Samples

The types and quantities of field QC samples are summarized in EPA Worksheet No. 22a provided in Attachment A.

13.2 Fixed Laboratory Analytical Quality Control Samples

The types and quantities of fixed laboratory QC samples are summarized in EPA

Worksheet No. 24a provided in Attachment A.

14.0 Data Acquisition Requirements

The Saugatucket River watershed has been the focus of several studies; however, only one study indicated levels of metals within the Indian Run Brook watershed that exceed RIDEM water quality criteria. This study was conducted by the University of Rhode Island Civil and Environmental Engineering Department researchers from 1996-1999. The URI study (Wright et al., 1999) established a sampling station at the confluence of the Saugatucket River and Indian Run Brook, and based on the results, it was assumed that the source of elevated metals is somewhere within the Indian Run Brook subwatershed. The major limitation to the data generated from the study is the lack of sampling stations on Indian Run Brook and that the data is now approximately 5 years old.

RIDEM anticipates that it's sampling will confirm the metals impairment and identify possible sources of the impairment.

To determine antecedent dry periods (ADPs) and wet weather sampling criteria, RIDEM will use rainfall data collected at the National Weather Service Cooperative Observer, Kingston, Rhode Island Station, maintained by the University of Rhode Island's Plant Science Department. Table 11 summarizes non-direct measurements used in the development of the Indian Run Brook study.

Table 11 Non-direct measurements criteria and limitations.

Non-direct Measurement	Data Source	Data Generator	How Data Will Be Used	Limitations on Data Use
Rainfall	National Weather Service Cooperative Observer, Kingston, Rhode Island Station	URI Plant Sciences Department	Quantify amount of rainfall in watershed	
Metals	Saugatucket Water Quality Investigations: Water Quality Data Report	Department of Civil and Environmental Engineering, URI	Evaluate instream water quality	Data is 5 years old

15.0 Documentation, Records, and Data Management

All samplers will be given either a field notebook or log sheets. The monitoring plan will

be given out when each sampler collects their equipment and includes specific information on what needs to be recorded on these sheets. All log sheets will be given to the field leaders at the conclusion of sampling. Initials on these sheets will identify the sampler. The Project Manager will review the sheets within three days to identify any possible errors or omissions. The Project manager will try to contact all samplers to identify any problems or additional feedback that would make any future sampling easier.

The Project Manager will designate a person to collect samples from the samplers. Each sampler will be responsible for filling out the chain-of-custody sheets. When the samples are picked up from the samplers, the Project Manager or designee will check the chain of custody sheets. The samples and chain of custody forms will also be checked at the laboratory during sample check in. A copy of the chain of custody form will be retained by RIDEM when the samples are dropped off at the laboratory. After analysis is complete, the analytical results will be forwarded to RIDEM.

After each sampling event, a brief Status Report will be written to document any changes to the Monitoring Plan. All information collected throughout the project will be summarized in the Final Data Report. Information included in the Final Data Report is described in Section 17.0. Table 12 summarizes the records that will be generated and maintained throughout this project.

Table 12 Project documentation and records.

Sample Collection Records	Field Analysis Records	Fixed Laboratory Records	Data Assessment Records
Field Notes/Log Sheets	Field Notes/Log Sheets	Chain of Custody Records	Status Reports
Chain of Custody Records	Not Applicable	Tabulated Data Summary Forms: draft and final	Final Data Report
Monitoring Plan	Not Applicable	Not Applicable	Not Applicable

16.0 Assessments and Response Actions

The Project Manager or designee will be responsible for each of the project tasks and their associated quality assurance and quality control procedures. The Project Manager will provide consistency between sampling events and sampling teams. Continual reports to the QA Officer concerning the status of sampling, quality assurance, and quality control will highlight any problems that are encountered during sampling. If needed, the QA Officer and Project Manager will halt sampling until problems are remedied.

Table 13 Project assessment table.

Assessment Type	Frequency	Internal or External	Person Responsible for Performing Assessment and Implementing Corrective Actions	Person Responsible for Monitoring the Effectiveness of the Corrective Action
Field Sampling Technical Systems Audit	Start of Sampling	I	Brandon Faneuf RIDEM	Wayne Jenkins RIDEM
Microinorganics, Inc Technical Systems Audit	Prior to Sample Receipt	E	Doug Cullen Microinorganics, Inc.	Brandon Faneuf RIDEM

17.0 QA Management Reports

Table 14 lists the QA Management Reports that will be generated throughout this study.

As needed during this project, the Project Manager and the QA Officer will meet to discuss any issues related to sampling. These meetings will be verbal status reports. Problems encountered in the field will be discussed and any appropriate actions determined and implemented. Any changes and/or problems will be included in the final report.

After each sampling event, the Project Manager will generate a Status Report. This Status Report will be the written record of any changes to the QA Plan. If a station was not sampled, it will be documented here. Issues discussed during the Verbal Status Report can also be included.

At the completion of all three events, the Project Manager will write a final report summarizing the three sampling events. Information in this final report will include the following information:

- Brief description of each sampling event;
- Data tables of all data collected during the sampling event (including rainfall); and
- Attachments
  - Status Reports
  - Sampling Logs
  - Chain of Custody forms
  - Laboratory data sheets provided by the labs

Table 14 QA management reports.

Type of Report	Frequency	Person(s) Responsible for Report Preparation	Report Recipient
Verbal Status Report	As needed	Brandon Faneuf RIDEM	Wayne Jenkins RIDEM
Written Status Report	After each wet weather survey	Brandon Faneuf RIDEM	Wayne Jenkins RIDEM
Final Report	Completion of sampling	Brandon Faneuf RIDEM	Wayne Jenkins RIDEM

18.0 Verification and Validation Requirements

Both the Project Manager and the QA Officer will review all data collected during this study to determine if the data meets QAPP Objectives. Decisions to qualify or reject data will be made by the Project Manager and QA Officer. All data collected will be included in the Final Report. To ensure correct interpretation of the data, all problems encountered in the field will be included in an Appendix to the report and discussed in the general text of the report. Problems will also be documented in each survey's written Status Report. To assist in data interpretation, statistical information on sampling events, including sampling size, sample mean, and sample variance, will be reported, where applicable. A discussion on duplicate precision and accuracy criteria and results will also be discussed in the Final Report.

19.0 Verification and Validation Procedures

All data collected during the study will be included in the appendix of the report. Once the data has been collected, it will be entered into Microsoft Excel files. The Project manager will proofread the data entry for errors and any discrepancies will be corrected. Outliers and inconsistencies will be flagged for further review with the QA Officer. The decision to discard data will be made by the Project manager and QA Officer. Problems will be discussed in the Final Report. Table 15 discusses the data verification process.

Table 15 Data verification process.

Verification Task	Description	I/E	Responsible for Verification
Field Notes	Field notes will be collected at the end of each day and reviewed. Any required corrective actions will be addressed with the field samplers prior to further sampling. After the field notes will be entered into Excel, the data will be proofread for any data entry errors. Copies of the field notes will be maintained in the project file.	I	Brandon Faneuf/RIDEM
Chain of Custody Forms	Chain of custody forms will be reviewed when samples are collected for delivery to the laboratory in the field and at the laboratory. The forms will be maintained in the project file.	I/E	Brandon Faneuf /RIDEM Doug Cullen/ Microinorganics, Inc.
Laboratory Data	All laboratory data packages will be verified internally by the laboratory performing the work for completeness prior to submittal. The data packages will be also reviewed by the sampling organization.	I/E	Brandon Faneuf /RIDEM Doug Cullen/ Microinorganics, Inc

I=Internal, E=External

Data validation will utilize the measurement performance criteria documented in EPA Worksheets 11b, 22a, and 24a of this report.

20.0 Data Usability/Reconciliation with Project Quality Objectives

As soon as possible after each sampling event, calculations and determinations for precision, completeness, and accuracy will be made and corrective action implemented if needed. If data quality indicators meet those measurement performance criteria documented throughout this QA Plan, the project will be considered a success. If there are data that do not meet the measurement performance criteria established in this QA Plan, the data may be discarded and sampled again or the data may be used with stipulations written about its accuracy in the Final Report. The cause of the error will be evaluated. If the cause is equipment failure, calibration/maintenance techniques will be reassessed and improved. If the problem is sampling team error, retraining will occur. Any limitations with the data will be documented in the Status Reports and the Final Report.

References

Marsh-McBirney, Inc. *Instruction Manual Model 201/201D Portable Water Flow Meter.*

Marsh-McBirney, Inc. (1990). *Model 2000 Installation and Operations Manual.*

Rainwise® Inc. (1997). *Installation and Operation of the Rainew Tipping Bucket Rain Gauge*.

RIDEM. Office of Water Resources. August 6, 1997. *Water Quality Regulations*.

Wright, R.M., Viator, O.J., and Li, Qianqian. 1999. *Saugatucket Water Quality Investigations: Water Quality Data Report*. Department of Civil and Environmental Engineering, University of Rhode Island, Kingston, R.I.

Attachment A – EPA Worksheets

Attachment B – Field Sampling SOPs

Attachment C – Laboratory Analytical SOPs

Attachment D – Blank Field Data Sheet